Let’s begin with a small robot for our first project that introduces the basic concepts of automated control. This robot decides where to go based on its surroundings and can change its path if the environment is changed. Linus’ purpose is to follow a black line on a white surface (see Figure 4-1). His aspirations are quite low, but he is still fun to experiment with and easy (and cheap) to build.

Figure 4-1. The mostly finished Linus sitting on his track
The cost of this project as shown is around $80. This includes a commercial motor-driver board, two hobby servo motors, a homemade IR sensor board, and several other items that might be used for multiple robots (Figure 4-2).

You also have the option to substitute your old usable parts like previously used servo motors (or gear-motors), or maybe you already have a motor-controller, at which point the price for this bot will drop quite a bit. If you want to save some money, you can also skip ahead to Chapter 6 to find out how to make your own PCBs on your PC with free software. You can also build these circuits on prototyping board from Radio Shack.

We start by making an infrared sensor board so that Linus can detect the color of the surface beneath him, and then go through the process of modifying a hobby servo motor for continuous rotation. Next we fit the rear wheels onto the motor output shafts and make a bracket for the front caster wheel. We then modify a tin container for use as our frame, and install the motors, infrared sensor board, Arduino with motor-controller shield, and batteries. After everything is wired up, we load the code onto the Arduino, make a track for Linus to follow, and start testing to see how fast we can get him to go around the track without losing his path. With Linus complete, you can then add LED interior lighting, a speed adjustment potentiometer, or paint his frame to add some style. Let’s look at the parts required to build Linus.

**Parts List for Linus**

For every project in this book, you are expected to have an Arduino ($35), so we won’t include that in each project price. In Chapter 6, we build a “poor-man’s Arduino” that is intended to replace your main Arduino when a project is completed so you don’t have to keep buying new Arduinos—unless you are rich. The price per board to build yourself is around $8-$15 each, but they can be programmed only with an FTDI cable ($15 from Sparkfun.com), because there is no USB interface built onto the homemade boards.

I also do not include tools or other standard materials (like wire) into each project price, because these will last for several projects. A roll of solid 22AWG wire should get you through most of the book, as should a roll of rosin-core solder. It is also handy to have a few pieces of scrap metal or aluminum on hand. A 36-inch long piece of flat aluminum stock enables you to make several brackets, supports, or motor mounts, so I keep a few different sized pieces in my parts bin.

This project uses some basic robotic components: sensors, motors, wheels, a frame, batteries, a motor-controller, and your Arduino micro-controller (Figure 4-2). If you already have a robot base with several of these components, you might complete this project for as little as $15 to build the infrared sensor board.